Electronic Version
Stylesheet Version v1.1.1

Claims

[c1] 1.A method of aligning signals from a first receiver located in a first clock domain to a second receiver located in a second clock domain, the method comprising the steps of:
creating a programmable delay element between the first and second receivers; and
selectively adding delay via the programmable delay element to the signals until the signals are aligned.

[c2] 2.The method of claim 1 wherein creating the programmable delay element comprises providing at least one selectable delay for each of a plurality of signal lines between the first and second receivers.

[c3] 3.The method of claim 2 wherein each selectable delay comprises a latch.

[c4] 4.The method of claim 1 wherein creating the programmable delay element comprises:
providing at least one selectable delay for each of a first plurality of signal lines adapted to receive signals transmitted from the first receiver to the second receiver; and
providing at least one selectable delay for each of a sec-

ond plurality of signal lines adapted to receive signals transmitted from the second receiver to the first receiver.

[c5] 5.The method of claim 4 wherein:
each selectable delay for the first plurality of signal lines comprises at least one latch that is clocked by a clock of the second clock domain; and
each selectable delay for the second plurality of signal lines comprises at least one latch that is clocked by a clock of the first clock domain.

[c6] 6.The method of claim 1 wherein selectively adding delay via the programmable delay element to the signals until the signals are aligned comprises:
(a)testing operation of the first and second receivers in response to differing delays between signals transmitted between the first and second receivers;
(b)determining one or more delays that cause the first and second receivers to exchange signals without errors; and
(c)employing the one or more delays to align signals transmitted between the first and second receivers.

[c7] 7.The method of claim 6 wherein steps (a)-(c) are performed automatically.

[c8] 8.A method of aligning signals transmitted between a

first receiver located in a first clock domain and a second receiver located in a second clock domain, the method comprising the steps of:

(a)providing at least one selectable delay for each of a first plurality of signal lines adapted to receive signals transmitted from the first receiver to the second receiver;

(b)providing at least one selectable delay for each of a second plurality of signal lines adapted to receive signals transmitted from the second receiver to the first receiver;

(c)testing operation of the first and second receivers in response to differing delays between signals transmitted between the first and second receivers;

(d)determining one or more delays that cause the first and second receivers to exchange signals without errors; and

(e)employing the one or more delays during subsequent transmission of signals between the first and second receivers.

[c9] 9.The method of claim 8 wherein steps (c)-(e) are performed automatically.

[c10] 10.An apparatus for use with an asynchronous interface having first receiver that operates in a first clock domain, a second receiver that operates in a second clock domain, and a plurality of signal lines adapted to exchange signals between the first and second receivers, the appa-

ratus comprising:
a first clock domain portion having at least a first delay circuit adapted to selectively introduce a first delay to a signal traveling from the second receiver to the first receiver via a first of the plurality of signal lines; and
a second clock domain portion having at least a second delay circuit adapted to selectively introduce a second delay to a signal traveling from the second receiver to the first receiver via a second of the plurality of signal lines.

[c11] 11.The apparatus of claim 10 wherein:
the first clock domain portion includes a first plurality of delay circuits, each of the first plurality of delay circuits adapted to selectively introduce a delay to a signal traveling from the second receiver to the first receiver via a different one of a first plurality of signal lines; and
the second clock domain portion includes a second plurality of delay circuits, each of the second plurality of delay circuits adapted to selectively introduce a delay to a signal traveling from the first receiver to the second receiver via a different one of a second plurality of signal lines.

[c12] 12.The apparatus of claim 11 wherein each delay circuit of the first plurality of delay circuits includes a plurality of selectable paths, each path having a different delay

associated therewith.

[c13] 13.The apparatus of claim 12 wherein each path has a different number of latches associated therewith.

[c14] 14.The apparatus of claim 13 wherein at least one path has N-1 latches, wherein N equals the number of signal lines between the first and second receivers.

[c15] 15.The apparatus of claim 11 wherein each delay circuit of the second plurality of delay circuits includes a plurality of selectable paths, each path having a different delay associated therewith.

[c16] 16.The apparatus of claim 15 wherein each path has a different number of latches associated therewith.

[c17] 17.An apparatus comprising:
an asynchronous interface having:
a first receiver that operates in a first clock domain;
a second receiver that operates in a second clock domain;
a plurality of signal lines adapted to exchange signals between the first and second receivers;
a supplemental asynchronous interface device (SAID) comprising:
a first clock domain portion having at least a first delay circuit adapted to selectively introduce a first delay to a

signal traveling from the second receiver to the first receiver via a first of the plurality of signal lines; and
a second clock domain portion having at least a second delay circuit adapted to selectively introduce a second delay to a signal traveling from the second receiver to the first receiver via a second of the plurality of signal lines.

[c18] 18.The apparatus of claim 17 wherein the first receiver comprises a first state machine and the second receiver comprises a second state machine.

[c19] 19.The apparatus of claim 17 wherein:
the plurality of signal lines comprises:
a first plurality of signal lines that travel through the first portion of the SAID; and
a second plurality of signal lines that travel through the second portion of the SAID;
the first clock domain portion includes a first plurality of delay circuits, each of the first plurality of delay circuits adapted to selectively introduce a delay to a signal traveling from the second receiver to the first receiver via a different one of the first plurality of signal lines; and
the second clock domain portion includes a second plurality of delay circuits, each of the second plurality of delay circuits adapted to selectively introduce a delay to a signal traveling from the first receiver to the second re-

ceiver via a different one of the second plurality of signal lines.

[c20] 20.A computer program product for aligning signals transmitted via an asynchronous interface between a first receiver located in a first clock domain and a second receiver located in a second clock domain, comprising:
a medium readable by a computer, the computer readable medium having computer program code adapted to:
(a)test operation of the first and second receivers in response to differing delays between signals transmitted between the first and second receivers;
(b)determine one or more delays that cause the first and second receivers to exchange signals without errors; and
(c)causing the asynchronous interface to employ the one or more delays during subsequent transmission of signals between the first and second receivers.